REMARKS

The present response is intended to be fully responsive to all points of objection and/or rejection raised by the Examiner and is believed to place the application in condition for allowance. Favorable reconsideration and allowance of the application is respectfully requested.

Applicants assert that the present invention is new, non-obvious and useful. Prompt consideration and allowance of the claims is respectfully requested.

Status of Claims

Claims **26-45** and **47** are pending.

Claims **26-45** and **47** have been rejected.

Preliminary Comment on Office action

Applicants are grateful to the Examiner for considering the remarks filed in Applicants' submission of April 3, 2009, and for withdrawing the rejections (a) under 35 U.S.C. § 112, first paragraph, (b) 35 U.S.C. § 112, second paragraph, and (c) under 35 U.S.C. § 103 relying on Yuan in view of Kim.

Concurrently, however, Applicants note with some disappointment that this is the fourth consecutive Office action in which the Yuan reference has been cited as a sole or primary reference. The Examiner is respectfully referred to MPEP § 707.07(f), which provides that even when withdrawing grounds of rejection, "[t]he examiner must, however, address any arguments presented by the applicant which are still relevant to any references being applied." In this case, the Examiner has not addressed Applicants' distinctions over the Yuan reference provided in the previous responses, and particularly, Applicants' detailed response of July 18, 2008.

As discussed below (and as discussed at a prior interview with the Examiner), the disclosure of the Yuan reference is significantly different than the inventions recited in the

present claims (regardless of the secondary reference). Accordingly, for at least the reasons provided below, all pending claims are allowable over the cited art.

CLAIM REJECTIONS

35 U.S.C. § 103 Rejections

In the Office action, the Examiner rejected claims 26-35, 37, 40-45 and 47 under 35 U.S.C. § 103(a), as being unpatentable over Yuan, et al. (US Patent No. 6,317,189) in view of Okumura, et al. (US Patent No. 5,796,447). Applicants traverse the rejection for at least the reasons that follow.

Applicants have previously described in detail the conventional drive technique, the drive technique of the Yuan reference, and the drive technique of the present claims. Although those arguments are reiterated and incorporated by reference herein, for the sake of brevity, they are only briefly summarized below. The Examiner is referred to the July 18, 2008 response for further detail.

The pending independent claims are 26 and 47, both reproduced (in part) below:

> 26. A distinct color LCD apparatus including:
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> . . .
>
> an electrical pulse driving means connected to said electrically conductive means and arranged to supply drive signals to the plurality of parallel addresses to drive the cholesteric liquid crystal material selectively into a homeotropic state or a planar state, the electrical pulse driving means being arranged to supply drive signals which provide a predetermined grey level by driving the cholesteric liquid crystal material, within successive frames each having a predetermined time period which is sufficiently short that an average reflectance of the color LCD apparatus over the predetermined time period is perceived without the appearance of visual flicker, into homeotropic state in a fraction of said predetermined time period and into the planar state in the remainder of said predetermined time period, said fraction being selected in accordance with the grey level.

47. A method of driving a distinct color LCD apparatus . . . the method comprising:

supplying electrical drive signals to said electrically conductive means to drive the cholesteric liquid crystal material selectively into a homeotropic state or a planar state, said drive signals providing a predetermined grey level by driving the cholesteric liquid crystal material, within successive frames each having a predetermined time period which is sufficiently short that an average reflectance of the color LCD apparatus over the predetermined time period is perceived without the appearance of visual flicker, into homeotropic state in a fraction of said predetermined time period and into the planar state in the remainder of said predetermined time period, said fraction being selected in accordance with the grey level.

In contrast to the above claims, the Yuan reference does not disclose the claimed electrical pulse driving means and driving method for at least two reasons.

First, the Yuan reference does not disclose "an electrical pulse driving means . . . arranged to supply drive signals which provide a predetermined grey level by driving the cholesteric liquid crystal material . . . into homeotropic state in a fraction of said predetermined time period and into the planar state in the remainder of said predetermined time period." Second, the Yuan reference does not disclose "the fraction being selected in accordance with the grey level."

Each of these distinctions is discussed in turn below.

I. The Yuan reference does not disclose driving the LC material using a mixed state of homeotropic and planar states for a fraction and a remainder of a time period.

The Yuan reference teaches producing a display image based on the <u>stable</u> planar and focal conic states, i.e., by making the cholesteric LC material reflective (bright) or non-reflective (dark). The unstable homeotropic state is formed only briefly for the purpose of resetting the cholesteric LC material prior to driving it into the desired planar and focal conic states. Thereafter, the cholesteric LC material is left in the planar and focal conic states until it is desired to change the image.

Thus, the Yuan reference only discloses relaxing the material into the stable planar state, relaxing the material into the stable focal conic state, or driving the material only briefly into the unstable homeotropic state as a preliminary step before allowing it to relax into the stable planar or focal conic states. There is no disclosure of driving the liquid crystal into a mixed state of intermediate reflectivity, as recited in the pending claims.

Specifically, in the Yuan reference, after being driven briefly into the homeotropic state, the material is then allowed to relax into either of the stable states (in other prior art it would usually be the planar state). It is specifically noted in the Yuan reference that what determines the stable state into which the material is relaxed is determined by the rate of the decrease in voltage. The actual time during which the material is in the homeotropic state is negligible and has no effect on the reflectivity. Accordingy, in the Yuan scheme only planar or focal conic state are achieved (and not the mixed state) by relaxing the voltage applied to the liquid crystal either rapidly or slowly, when it then relaxes into planar or focal conic.

Therefore, the Yuan reference does not disclose "an electrical pulse driving means . . . arranged to supply drive signals which provide a predetermined grey level by driving the cholesteric liquid crystal material, within a predetermined time period, into homeotropic state in a fraction of said predetermined time period and into the planar state in the remainder of said predetermined time period. . ."

Applicants reiterate that the fraction of time that the liquid crystal is driven in the homeotropic state is designed to be negligible in the Yuan reference. It will be recalled that unlike the stable focal conic and planar states (which are stable with time), driving the liquid crystal in the unstable homeotropic state requires application of energy. Therefore, the display of Yuan, which relies on the stable states requires little or no power to maintain. The homeotropic state (which must be actively driven) is only briefly entered merely as a means to access these states, therefore, little power is required for the display. The Yuan reference specifically discloses (and touts as a key advantage) that it is designed to produce a gray level display with a very small application of energy:

> This bistable memory capability of the holographic polymer dispersed cholesteric liquid crystal display 40 can further reduce the power consumption by an order of magnitude in many applications, because the display consumes no power when viewed

> and only needs to be powered for short periods of time to change the displayed image. (col. 10 lines 18-23, emphasis added)

Therefore, it would also not have been obvious to modify Yuan to use the homeotropic state as a display state together with one of the stable states (e.g., the planar state) to produce a gray level. The Yuan reference in fact teaches away from using the unstable homeotropic state to achieve a grey level because this would eliminate the power-saving benefit touted by the Yuan reference.

In contrast to the Yuan reference, the present invention obtains grey levels using a particular driving scheme of the unstable homeotropic state and the stable planar state.

Generally, as described in the specification, in the homeotropic state the material is practically transparent, but in the planar state the material is reflective. Therefore, the viewer perceives an average reflectance due to the persistence of vision. The greater the fraction, the longer the time in the homeotropic state as compared to the planar state, and accordingly, the lower the average reflectance. Thus, the fraction of the time that the liquid crystal is driven in the homeotropic state determines the gray level of the display.

As recited in the claims, the cholesteric LC material is driven into the homeotropic and planar states for different parts (a fraction and a remainder) of a predetermined time period. Specifically, the claims specify that the LC material is driven into the homeotropic state for a fraction of the time period and into the planar state for the remainder of the time period.

The following example illustrates the driving arrangement recited in claims 26 and 47. In order to obtain a first gray level, for a predetermined time period T, which may be for example, 15 to 20ms, the liquid crystal may be driven into the homeotropic state for a fraction of time T (e.g., T/4), and in the remainder of the time (e.g., 3T/4), the liquid crystal would be in the planar state. In order to obtain a second different gray level, for a predetermined time period T, the liquid crystal would be driven into the homeotropic state for a different fraction of time T (e.g., T/8), and in the remainder of the time (e.g., 7T/8), the liquid crystal would be in the planar state.

Accordingly, the present claims teach presenting a grey level using only two states – the homeotropic state and the focal conic state. Therefore, the claims are further unlike the Yuan reference, because according to the present claims, the material does not enter the focal conic state at all.

II. The Yuan reference does not disclose selecting a fraction of the predetermined time period in accordance with a grey level.

The Yuan reference produces different reflectances by relaxing the LC material rapidly or slowly into either the planar or focal conic states.

The Examiner points out (Office action, p. 3) that in some instances, the Yuan reference may teach relaxing the material into the planar state. Thus, for example, the material may be relaxed quickly from the homeotropic state, thereby producing the stable planar state. Therefore, the material will have been in the homeotropic state for a certain time, and then in a planar state for an additional time. The Examiner therefore argues that in such a state, the material is in the homeotropic state for a fraction of a time period, and in the planar state for a remainder of the time period.

However, even in this case, the fraction of the time during which the material is in the homeotropic state (with relation to the time during which the material is in the planar state) is <u>not</u> determined by the grey level. That is to say, this does not mean that Yuan discloses "an electrical pulse driving means . . . arranged to supply drive signals which provide a predetermined grey level by driving the cholesteric liquid crystal material, within successive frames . . . into homeotropic state in a fraction of said predetermined time period and into the planar state in the remainder of said predetermined time period, <u>said fraction being selected in accordance with the grey level</u>."

Consider an example (according to the Yuan reference), where the material is in the unstable homeotropic state for a brief time δ, and then in the stable planar state for time t_1. The reflectivity of the material as seen by an observer will be defined solely by the planar state, not by the relation of δ to t_1. Likewise, where the material is in the unstable homeotropic state for the same brief time δ, and then in the stable planar state for a longer time t_2 (i.e., $t_2>t_1$), there will be no difference in the reflectivity of the material as seen by an

observer, even though $\delta/(\delta+t_1)>\delta/(\delta+t_2)$. (It will be recalled that the amount of time that the material is in the homeotropic state is irrelevant to the ultimate stable state, but rather only the rate at which the material is relaxed.)

In contrast, according to the present claims, a fraction is selected in accordance with a desired grey level, and this fraction is used in successive frames to determine pro rata the time the material is in the homeotropic state in relation to the time the material is in the planar state. By varying this fraction, the grey level displayed is increased. This pulse driving means and method are not disclosed in the Yuan reference.

The Examiner has cited Yuan col. 10, lines 34-42 and col. 11, lines 20-33. These passages read:

> In this display, the cholesteric liquid crystal is confined in droplets the cholesteric liquid crystal layers 70 which alternate with the polymer layers.
>
> Figs. 6(a) and 6(b) show the holographic polymer dispersed cholesteric liquid crystal display 60 in the off-state, in which no voltage is applied to the electrodes 64. In the off-state, the cholesteric liquid crystal material in the cholesteric liquid crystal layers 70 is in the planar state in which the helical axes are substantially perpendicular to the incident light surface 72.
>
> * * *
>
> The behaviour of the cholesteric liquid crystal material in the cholesteric liquid crystal layers 70 in the holographic polymer dispersed cholesteric liquid crystal display 60 to the release of the high applied voltage to a lower voltage is the same as the behaviour described above for the holographic polymer dispersed cholesteric liquid crystal display 40. That is the homeotropic texture shown in Fig 6(f) relaxes to one of the focal conic texture shown in Fig. 6(d), or the planar texture shown in Fig. 6(b), depending on the rate of decrease of the voltage. If the voltage is quickly released, then the homeotropic texture relaxes to the planar texture of Fig. 6(b), and cells 61 of the holographic polymer dispersed cholesteric liquid crystal display 60 reflect light of both intrinsic peak wavelengths R_1 and R_2.

As discussed above, these passages do not disclose the elements of claims 26 or 47, which require driving the cholesteric LC material into homeotropic state in a fraction of said

predetermined time period and into the planar state in the remainder of said predetermined time period, the fraction being selected in accordance with the grey level.

The above passages of the Yuan reference simply disclose driving the cholesteric LC material into the homeotropic state and then selectively either (1) removing the drive voltage quickly so that the cholesteric LC material relaxes to the planar state or (2) removing the drive voltage slowly so the cholesteric LC material relaxes into the focal conic state. For example, in Yuan there is no variation between cases (1) and (2) of a fraction of a period within which the cholesteric LC material is driven into homeotropic state. Furthermore, in Yuan in case (2) the cholesteric LC material is not driven into the planar state at all, as required by claims 26 and 47.

III. The Yuan and Okumura references do not disclose successive frames of homeotropic and planar states, each having a predetermined time period sufficiently short that an average reflectance over the predetermined time period is perceived without visual flicker.

The Examiner has agreed that the Yuan reference does not specifically teach a pulse driving means and method including "successive frames each having a predetermined time period which is sufficiently short that an average reflectance of the color LCD apparatus over the predetermined time period is perceived without the appearance of visual flicker." It will be recalled that these claimed frames include only the homeotropic state (for a fraction of the time period) and the planar state (the remainder of the time period).

Therefore, if the definition of the frames having the predetermined time period is novel over Yuan, then the requirement to drive into "into homeotropic state in a fraction <u>of said predetermined time period</u> and into the planar state in the remainder <u>of said predetermined time period</u>" is novel over Yuan.

This is not simply a matter of semantics. To the contrary, it expresses the technical distinction between the claimed inventions and the Yuan reference. In particular, the present invention uses the both homeotropic and planar states <u>within a short frame</u> to provide the display with the desired reflectance to display an image. In contrast, as discussed above, Yuan uses the planar and focal conic states to provide the display with the desired reflectance

to display an image, and uses the homeotropic state only briefly as a way to access the planar and focal conic states.

For this element (which the Examiner has agreed is absent from the Yuan reference), the Examiner has cited the Okumura reference, and in particular, the following passage therein:

> FIG. 4 shows still another embodiment of the present invention in which a plurality of pixels are arrayed, as in the case of FIG. 2A. The embodiment shown in FIG. 4 is characterized in that the polarity of a reference power supply potential VCOM is alternately inverted at every pixel. For example, in a pixel PIXEL1, a reference power supply potential VCOM4 is set at 0 V, and the signal line potential is at OV (color absorption state) to 15 V (transparent state). In a pixel PIXEL2, a reference power supply voltage VCOM5 is set at 15 V, and the signal line potential is at 15 V (color absorption state) to 0 V (transparent state). In this manner, the pixels PIXEL1 and PIXEL2 are set to polarities opposite to each other. Further, the polarity is alternately inverted at every frame or line. With this operation, flicker components in adjacent pixels are canceled to obtain a good image free from flicker.

Applicants have reviewed the Okumura reference thoroughly, and respectfully submit that there is no connection between the teachings of the Okumura reference and the Yuan reference. In particular, the above passage does not disclose driving the LC material into successive frames of homeotropic and planar states. Therefore, it is unclear to Applicants how the Okumura reference can be used to teach <u>successive frames of homeotropic and planar states</u>, each frame having a predetermined time period which is sufficiently short that an average reflectance of the color LCD apparatus over the predetermined time period is perceived without the appearance of visual flicker.

Accordingly, it would not have been obvious to combine the teachings of the Yuan and Okumura reference, and even if it was, the result would not be the recitation of claims 26 and 47. Therefore, and for all of the above reasons, claims 26 and 47, and claims dependent thereon are allowable over the Yuan and Okumura references.

In the Office action, the Examiner rejected claims 36 and 39 under 35 U.S.C. § 103(a), as being unpatentable over Yuan et al. (US Patent No. 6,317,189) in view of

Okumura et al. (US Patent No. 5,796,447) and in further view of Harada et al. (US Patent No. 6,618,102). The Harada reference does not rectify the defects of the rejection of base claim 26 over the Yuan and Okumura references. Accordingly, claims 36 and 39, which depend from allowable base claim 26, should likewise be allowed.

In the Office action, the Examiner rejected claim 38 under 35 U.S.C. § 103(a), as being unpatentable over Yuan et al. (US Patent No. 6,317,189) in view of Okumura et al. (US Patent No. 5,796,447) and in further view of Kim et al. (US Patent No. 7,205,970). The Kim reference does not rectify the defects of the rejection of base claim 26 over the Yuan and Okumura references. Accordingly, claim 38, which depends from allowable base claim 26, should likewise be allowed.

In view of the foregoing amendments and remarks, Applicants assert that the pending claims are allowable. Their favorable reconsideration and allowance is respectfully requested.

Should the Examiner have any question or comment as to the form, content or entry of this Amendment, the Examiner is requested to contact the undersigned at the telephone number below. Similarly, if there are any further issues yet to be resolved to advance the prosecution of this application to issue, the Examiner is requested to telephone the undersigned counsel.

Please charge any fees associated with this paper to deposit account No. 50-3355.

Respectfully submitted,

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